REMARKS

Summary of Amendments

The title has been amended, in particular to correct "resistance"—as rendered by WIPO from the Japanese in the PCT International Stage of this application—to "resistivity."

Claim 1 has been amended to incorporate the limitations of claims 2 and 5, and accordingly, claims 2 and 5 have been canceled.

Claims 1, 3, 4 and 6-15 are thus pending.

Double Patenting

Claims 1-7 and 15 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claim 6 of Applicants' co-pending App. No. 10/541,184.

Claim 6 of App. No. 10/541,184 reads:

> Semiconductor diamond being *n*-type, characterized in incorporating, from a crystal face thereof to the same depth, 10 ppm or more of each of *Li* and *N*, and in that its sheet resistance is 10^7 Ω/□ or less.

Although the at least 10^{17} cm^{-3} concentration of lithium atoms and nitrogen atoms recited in claim 1 of the instant application amounts to at least 1.78 ppm, there any such similarity between claim 1 of the instant application as now amended and claim 6 of the '184 application ends. Namely, by the present amendment, claim 1 of the present application now reads:

> Low-resistivity *n*-type semiconductor diamond characterized in containing 10^{17} cm^{-3} or more of lithium atoms and nitrogen atoms together; wherein:
>
> the lithium-atom concentration C_{Li} and the nitrogen-atom concentration C_N within the low-resistivity *n*-type semiconductor diamond are $0.1 \leq C_{Li}/C_N \leq 10.0$; and
>
> the center-to-center distance between the lithium atoms and nitrogen atoms is from 0.145 nm to 0.155 nm.

It is respectfully submitted that because claim 1 now recites limitations that patentably distinguish the claim over claim 6 of the '184 application, the double-patenting rejection has been overcome.

Claim Rejections – 35 U.S.C. § 103

Claims 1-7 and 15 were rejected under 35 U.S.C. § 103 for obviousness over U.S. Pat. App. Pub. No. 2001/0043903 to D'Evelyn et al., (submitted to the Office in Applicants' IDS of June 6, 2006), in combination with an allegation that a person skilled in the art could arrive at the present invention through routine experimentation to optimize result-effective variables.

As the examiner casually notes, D'Evelyn '903 does teach *n*-type semiconductor diamond doped with dopants that can be nitrogen and lithium. But that is as far as the similarity between D'Evelyn '903 and the present invention goes.

The only mention in D'Evelyn '903 of the semiconducting properties of diamond is in paragraph [0026], and that mention is in a negative sense only. For example, paragraph [0026] states that "[W]hen the dopant element is nitrogen, hydrogen, nickel, cobalt, oxygen, or a mixture thereof, the diamond crystal . . . cannot generally function as a semiconductor." Thus, D'Evelyn '903 would seem to teach quite away—not at all toward—the present invention, which is directed toward doping diamond to lend it low-resistivity, *n*-type semiconducting properties, while ensuring that the diamonds' crystallinity is excellent.

More particularly, D'Evelyn '903 is directed to imparting tangential compressive stresses superficially into diamond by doping the diamond in such as way as to set up a "positive radial gradient" of the dopant(s) to strengthen and toughen the diamond crystal. Establishing the positive radial gradient requires that the dopant be present in increasing concentration with increasing radius of the diamond.

The present invention of course has nothing whatever to do with such gradients; in *n*-type semiconductor diamond according to the present invention, Li and N are present in a uniform distribution throughout the diamond crystal. The description in the present specification states, "From this result it may be inferred that adjacent to the majority of the nitrogen atoms lithium atoms were present. . . . [T]he lithium atoms and nitrogen atoms were present in proximate locations" (page 15, last line, to page 16 line 6). Moreover, as noted in line 22, page 11 to line 3, page 12:

> it was discovered that if diamond is doped simultaneously with lithium atoms and nitrogen atoms, and the center-to-center distance between the lithium atoms and the nitrogen atoms is 0.145 or more but 0.155

nm or less then the diamond will be a low-resistivity n-type semiconductor.

Such distinctions over the D'Evelyn '903 teachings are now clear from claim 1, which as amended recites:

> Low-resistivity *n*-type semiconductor diamond characterized in containing 10^{17} cm^{-3} or more of lithium atoms and nitrogen atoms together; wherein:
>
> the lithium-atom concentration C_{Li} and the nitrogen-atom concentration C_N within the low-resistivity *n*-type semiconductor diamond are $0.1 \leq C_{Li}/C_N \leq 10.0$; and
>
> the center-to-center distance between the lithium atoms and nitrogen atoms is from 0.145 nm to 0.155 nm.

A salient distinction between the present invention and D'Evelyn '903 is that according to the present invention, N replaces C; nitrogen is present in substational sites within the diamond lattice. And a synergistic effect results: As stated in the specification, "the lithium atoms present in the lattice interstices [are] steadied by the nitrogen atoms present in the substitutional sites" (page 16, lines 19 and 20). This feature discussed above could never result from a dopant gradient, as taught by D'Evelyn et al., and D'Evelyn et al. is totally silent as to any synergistic effects from doping diamond simultaneously with lithium and nitrogen.

It is respectfully submitted that for the foregoing reasons, claim 1 is patentable over the prior art of record, and hence so are claims 3, 4 and 6-15 depend directly or indirectly from claim 1.

Allowable Subject Matter

Applicants gratefully acknowledge that independent claim 8 and its dependent claims 9-14 have been allowed.

Accordingly, Applicants courteously urge that this application is in condition for allowance. Reconsideration and withdrawal of the rejections is requested. Favorable action by the Examiner at an early date is solicited.

Respectfully submitted,

February 1, 2007 /James Judge/

James W. Judge
Registration No. 42,701

JUDGE & MURAKAMI IP ASSOCIATES
Dojima Building, 7th Floor
6-8 Nishitemma 2-Chome, Kita-ku
Osaka-shi 530-0047
JAPAN

Telephone: **305-938-7119**
Voicemail/Fax: **703-997-4565**